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High Resolution Fluorescence Imaging with the Metal Nanoparticles Sheet for Interfacial Study of Adhesive Cells

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1. Introduction

Recently, we found that the self-assembled metal nanoparticles (NPs) sheet confined the light homogeneously in a few ten nanometers region from the sheet by collective excitation of localized surface plasmon resonance (LSPR) [1]. In this study, we attempted to image the cell-attached interface by using oleylamine-capped gold (AuOA) NPs sheet as an imaging substrate. We examined the optimal conditions for high-resolution, high speed imaging, toward a future live cell imaging.

2. Experimental method

The AuOA sheet was fabricated at air-water interface and transferred onto hydrophobized cover slip by the Langmuir-Schaefer (LS) method. Rat basophilic leukemia (RBL-2H3) cells were incubated for 1 hour or overnight on the substrate and fixed. Then the cell membranes were disrupted and labeled by TRITC fluorescent dye. The total internal reflection fluorescence (TIRF) microscope was used to obtain the fluorescence images under the different incident angles.

3. Results and Discussion

Figure 1 shows images obtained on the glass (left) and on the AuOA sheet (right) under perpendicular (0°) and grazing (75°) incident lights. The cells were attached on the AuOA sheet as good as that on the cover slip. The enhanced and the confined electric field by LSPR gave a clear image of the focal adhesion, even under the perpendicular incident light [2]. The brighter spots in the images correspond to the contacting points of the cells, which must be located in a few ten nanometers region from the AuOA sheet (Under the regular TIRF imaging, the evanescent light was generated in 100 nm region from interface). It was necessary that the excitation and emission wavelengths of the dyes were overlapped with LSPR wavelength, in order to obtain the LSPR enhancement effect. This imaging substrate composed of self-assembled AuOA NPs enabled high axial, lateral and temporal resolution imaging, even without TIRF optical system.

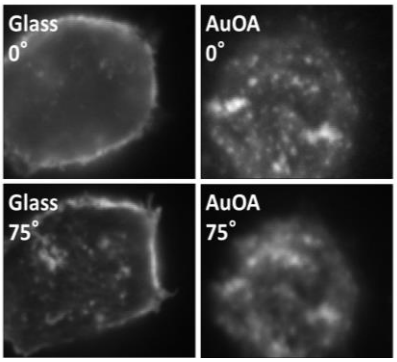

Fig.1 Fluorescence images on glass (left) and on AuOA sheet (right) under the different incident angles (0 and 75°).

[1] E. Usukura, S. Shinohara, K. Okamoto, J. Lim, K. Char and K. Tamada, *Appl. Phys. Lett.*, 104, 5 (2014).

[2] S. Masuda, Y. Yanase, E.Usukura, S. Ryuzaki, K. Okamoto, K. Tamada, in preparation (2016).